

WHAT IS CLAIMED AND DESIRED TO BE SECURED BY LETTERS
PATENT OF THE UNITED STATES IS:

1. A sequencer, comprising:

5 a light transmitting device configured to sequentially output a first light comprising a first set of primary colors and a second light comprising a second set of primary colors different from the first set of primary colors.

10 2. The sequencer according to Claim 1, wherein the light transmitting device comprises a wheel having color transmissive filters configured to produce the first light and the second light.

15 3. The sequencer according to Claim 1, wherein the light transmitting device comprises an electronic color sequential shutter.

20 4. The sequencer according to Claim 3, wherein the electronic color sequential shutter comprises a shutter based on liquid crystal technology.

5. The sequencer according to Claim 3, wherein the electronic color sequential shutter comprises a shutter based on surface mode technology.

5 6. The sequencer according to Claim 1, wherein the light transmitting device comprises a wheel having an RGB color transmissive filter section and a YMC color transmissive section.

10 7. The sequencer according to Claim 1, wherein the first set of primary colors and the second set of primary colors include blue.

15 8. The sequencer according to Claim 1, wherein the first set of primary colors comprises RGB and the second set of primary colors comprises YCB.

9. A system, comprising:
20 a set of light modulators; and
drive electronics configured to drive the set of light modulators with subframes of a video image;
wherein the subframes comprise a first subframe comprising a first set of primary colors and a second subframe comprising a

second set of primary colors different from the first set of primary colors.

10. The system according to Claim 9, wherein the first set
5 of primary colors comprises Red, Green, and Blue (RGB) primary colors and the second set of primary colors comprises Yellow, Magenta, and Cyan (YMC) primary colors.

11. The system according to Claim 9, wherein the first set
10 of primary colors comprises a blue primary color, and the second set of primary colors comprises a blue primary color.

12. The system according to Claim 9, wherein the first set
of primary colors comprises Red, Green, and Blue primary colors
15 and the second set of primary colors comprises Cyan, Yellow, and Blue primary colors.

13. The system according to Claim 9, wherein:
the drive electronics are configured to be synchronized
20 with a lighting device that sequentially provides input light to the set of light modulators comprising the first set of primary colors and the second set of primary colors, such that the modulation devices are illuminated by light from the first set of primary colors when driven with the first subframe, and the

modulation devices are illuminated by light from the second set of primary colors when driven with the second subframe.

14. The system according to Claim 9, further comprising:

5 a kernel configured to separate input light into a set of individual primary color light beams and individually direct each primary color light beam to a corresponding one of the light modulators;

10 a lighting device configured to sequentially input light comprising the first set of primary colors and then light comprising the second set of primary colors to the kernel;

wherein:

15 the drive electronics are synchronized with the lighting device such that the modulation devices are illuminated by light from the first set of primary colors when driven with the first subframe, and the modulation devices are illuminated by light from the second set of primary colors when driven with the second subframe; and

20 the modulation devices are driven with each subframe such that each respective modulation device is driven by a color portion of each subframe corresponding to the primary color light beam directed to the respective modulation device.

15. The system according to Claim 7, wherein the modulation devices comprise LCoS microdisplays.

16. A projection device configured to display an image 5 comprising at least two subframes, wherein each subframe comprises an independent set of primary colors.

17. The projection device according to Claim 1, wherein the at least two subframes comprise a first subframe comprising 10 red, green, and blue primary colors, and a second subframe comprising yellow, magenta, and cyan primary colors.

18. The projection device according to Claim 1, wherein the independent sets of primary colors are chosen from red, 15 green, blue, yellow, magenta, and cyan.

19. The projection device according to Claim 1, wherein at least two of the subframes include a blue primary color.

20. The projection device according to Claim 1, wherein the at least two subframes comprise a first subframe comprising red, green, and blue primary colors, and a second subframe comprising yellow, cyan, and blue primary colors.

21. An apparatus, comprising:

5 a color sequencer configured to provide a sequence of color transmissive filters;

wherein a size of a segment of each color transmissive filter in the sequence is proportional to an efficiency of a device to be used with the color sequencer.

10

22. The apparatus according to Claim 1, wherein the color sequence comprises at least one RGB segment and at least one YCM segment.

15

23. The apparatus according to Claim 1, wherein the color sequence comprises at least one red segment, at least one blue segment, and at least one green segment.

20

24. The apparatus according to Claim 3, wherein the color sequence further comprises at least one cyan segment.

25. The apparatus according to Claim 3, wherein the color sequence further comprises at least one magenta segment.

26. The apparatus according to Claim 1, wherein the color sequence comprises at least two segments containing blue.

27. The apparatus according to Claim 1, further
5 comprising:

a light source configured to direct light into the color sequencer; and

a kernel configured to receive and modulate color sequenced light from the color sequencer.

10

28. The apparatus according to Claim 7, wherein the proportion of each segment of color sequenced light is proportional to both an amount of each color light from the light source and an efficiency of modulation performed by the
15 kernel.

29. The apparatus according to Claim 7, wherein the light modulator comprises a prism assembly and at least one light modulator.

20

30. The apparatus according to Claim 9, wherein the light modulator comprises a microdisplay.

31. A television,

comprising:

a display; and

5 electronics configured to drive the display with image frames, each image frame comprising a first image subframe and a second image subframe;

wherein:

10 the first image subframe comprises an image in a first set of primary colors; and

 the second image subframe comprises an image in a second set of primary colors different from the first set of primary colors.

15 32. The television according to Claim 1, wherein the first set of primary colors comprises red, green and blue primary colors and the second set of primary colors comprises yellow, magenta, and cyan primary colors.

20 33. The television according to Claim 1, wherein the first set of primary colors comprises red, green, blue and cyan yellow blue.

34. The television according to Claim 1, wherein the first set of primary colors and the second set of primary colors both include blue.

5 35. The television according to Claim 1 further comprising:

a light engine, comprising;

a kernel,

10 a light source configured to input light comprising a repeating sequence of the first set of primary colors and then the second set of primary colors to the kernel,

a set of light modulators configured to modulate light prior to output from the kernel, and

15 a lens configured to project modulated light output from the kernel to the display;

wherein the electronics drive the display by,

inputting content for the first image subframe to the light modulators in synchronicity with light of the first primary colors input to the kernel, and

20 inputting content for the second image subframe to the light modulators in synchronicity with light of the second primary colors input to the kernel.

36. An LCoS based television, comprising:

a kernel, comprising a set of optical components comprising an input face, an output face, and a set of processing faces;

5 a light source configured to direct light of alternating sets of primary colors to the input face;

a set of reflective LCoS microdisplays, each reflective LCoS microdisplay individually attached to one of the processing faces;

10 a microdisplay driver configured to drive the set of microdisplays with a series of frames for a video image;

a display screen; and

a projection lens configured to project light modulated by the microdisplays from the output face onto the projection screen;

15 wherein:

each frame comprises a series of subframes each having an independent set of primary colors; and

20 the microdisplay driver is configured to drive the microdisplays with a subframe comprising a set of primary colors synchronized with light comprising a matching set of primary colors directed to the input face by the light source.

37. A projector, comprising:

a kernel configured to modulate light;

a lighting device configured to provide input light to the kernel; and

5 a projection lens configured to project modulated light output from the kernel.

wherein:

the kernel comprises,

a set of light modulators, and

10 optics configured to separate the input light into individual primary colored light beams, direct each primary colored light beam to a respective one of the modulators for modulation, and recombine the modulated primary colored light beams to produce the modulated light output from the kernel; and

15 the lighting device is configured to provide the input light in a sequence that comprises light comprising a first set of primary colors and light comprising a second set of primary colors different from the first set of primary colors.

20 38. The projector according to Claim 1, wherein the first set of primary colors comprises Red, Green, and Blue (RGB) primary colors and the second set of primary colors comprises Yellow, Magenta, and Cyan (YMC) primary colors.

39. The projector according to Claim 1, wherein the first set of primary colors comprises a blue primary color, and the second set of primary colors comprises a blue primary color.

5 40. The projector according to Claim 1, wherein the first set of primary colors comprises Red, Green, and Blue primary colors and the second set of primary colors comprises Cyan, Yellow, and Blue primary colors.

10 41. The projector according to Claim 1, further comprising drive electronics configured to drive each respective light modulator with a color content corresponding to the primary colored light beam directed to the respective light modulator.

15 42. The projector according to Claim 5, wherein the light modulators comprise reflective LCoS microdisplays.

43. The projector according to Claim 1 wherein:
the lighting device comprises,
20 a light source, and
a color wheel configured to interact with light emanating from the light source to produce the input light provided to the kernel;

the projector further comprises drive electronics configured to drive the light modulators with subframes of an image to be displayed by the projector, the subframes comprising a subframe of the first primary color set and a subframe of the 5 second primary color set; and

the drive electronics and color wheel are synchronized such that the light modulators are driven with subframes of the first primary color set while primary colored light beams from the first primary color set are directed at the light modulators and 10 subframes of the second primary color set while primary colored light beams from the second primary color set are directed at the light modulators

44. The projector according to Claim 7, wherein the color 15 wheel comprises Red, Green, and Blue primary color section and a Cyan, Yellow, and Blue primary color section.

45. The projector according to Claim 7, wherein the color wheel comprises a Red, Green, and Blue (RGB) primary color 20 section and a Yellow, Magenta, and Cyan (YMC) primary color section.

46. The projector according to Claim 7, wherein the first set of primary colors comprises a blue primary color, and the second set of primary colors comprises a blue primary color.

5 47. The projector according to Claim 1 wherein:
 the lighting device comprises,
 a light source, and
 a electronic color sequential shutter configured to
 interact with light emanating from the light source to produce
10 the input light provided to the kernel;
 the projector further comprises drive electronics
 configured to drive the light modulators with subframes of an
 image to be displayed by the projector, the subframes comprising
 a subframe of the first primary color set and a subframe of the
15 second primary color set; and
 the drive electronics and electronic color sequential
 shutter are synchronized such that the light modulators are
 driven with subframes of the first primary color set while
 primary colored light beams from the first primary color set are
20 directed at the light modulators and subframes of the second
 primary color set while primary colored light beams from the
 second primary color set are directed at the light modulators.

48. The projector according to Claim 11, wherein the first set of primary colors comprises a blue primary color, and the second set of primary colors comprises a blue primary color.

5

49. A device comprising:

a color sequential illuminator configured to sequentially input at least two different sets of primary colors;

a kernel comprising,

n light modulators, and

10

optics;

a drive device configured to display a video image content on the microdisplays;

wherein;

the optics are configured to separate light from the color sequential illuminator into individual primary color light beams and respectively illuminate each of the n light modulators with one of the individual primary color light beams;

the drive electronics are configured to respectively display individual primary color portions of the video image content respectively on each microdisplay synchronously with 5 illumination of the microdisplay by a same color primary light beam such that a first primary color illuminates a first light modulator while displaying a first primary color portion of the image, and an nth primary color illuminates an nth light modulator while displaying an nth primary color portion of the 10 image.

50. A method, comprising the steps of:
providing an input light comprising a first set of n primary colors;
15 dividing the first input light into a set of n primary color light beams;
applying a first of the primary color light beams to a light modulator configured to modulate the first primary color light beam with image content of a same color as the first primary color light beam;
20 applying a second of the primary color light beams to a light modulator configured to modulate the second primary color light beam with image content of a same color as the second primary color light beam;

applying an nth of the primary color light beams to a light modulator configured to modulate the nth primary color light beam with image content of a same color as the nth primary color light beam;

5 changing the input light such that it comprises a second set of primary colors; and

repeating said steps of dividing and applying with respect to the changed input light.

10 51. A kernel configured to utilize 6 primary light channels in a color sequential mode.

52. The kernel according to Claim 1, wherein the color sequential mode comprises sequentially illuminating the kernel 15 with alternating sets of primary colors; and the kernel further comprises a set of optical elements configured to operate on each set of primary colors.

53. The kernel according to Claim 1, further comprising an 20 input light path and a Green + Yellow / Magenta + Cyan ColorSelect type waveplate in the input path.

54. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and

5 a Green + Yellow / Magenta + Cyan ColorSelect waveplate positioned in an input light channel of the kernel.

55. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

10 an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and

15 a Green + Yellow dichroic positioned between the input beamsplitter and the first processing beamsplitter.

56. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

20 an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and

a Magenta + Cyan dichroic positioned between the input beamsplitter and the second processing beamsplitter.

57. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
an input beamsplitter and an output beamsplitter on a first
5 diagonal of the kernel;
a first processing beamsplitter and a second processing
beamsplitter on a second diagonal of the kernel; and
a Red + Magenta / Blue + Cyan ColorSelect waveplate
positioned between the input beamsplitter and the second
10 processing beamsplitter.

58. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
an input beamsplitter and an output beamsplitter on a first
15 diagonal of the kernel;
a first processing beamsplitter and a second processing
beamsplitter on a second diagonal of the kernel;
a Magenta + Cyan dichroic positioned between the input
beamsplitter and the second processing beamsplitter; and
20 a Red + Magenta / Blue + Cyan ColorSelect waveplate
positioned between the input beamsplitter and the second
processing beamsplitter.

59. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

5 a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and
a Blue + Cyan / Red + Magenta ColorSelect waveplate between the second processing beamsplitter and the output beamsplitter.

10 60. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

15 a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel;
a Green + Yellow / Magenta + Cyan ColorSelect type optical element positioned in an input light channel of the kernel;
a Magenta + Cyan dichroic type optical element positioned between the input beamsplitter and the second processing beamsplitter;

20 a Red + Magenta / Blue + Cyan ColorSelect type optical element positioned between the input beamsplitter and the second processing beamsplitter; and

a Blue + Cyan / Red + Magenta ColorSelect type optical element positioned between the second processing beamsplitter and the output beamsplitter.

5 61. A kernel configured to utilize 5 primary light channels in a color sequential mode.

62. The kernel according to Claim 1, wherein the color sequential mode comprises sequentially illuminating the kernel 10 with alternating sets of primary colors; and the kernel further comprises a set of optical elements configured to operate on each set of primary colors.

15 63. The kernel according to Claim 2, wherein the alternating sets of primary colors each comprise 3 primary colors, and each set of primary colors have a blue primary color.

20 64. The kernel according to Claim 1, further comprising an input light path and a Green + Cyan / Red + Yellow + Blue ColorSelect type waveplate in the input path.

65. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
an input beamsplitter and an output beamsplitter on a first
5 diagonal of the kernel;
a first processing beamsplitter and a second processing
beamsplitter on a second diagonal of the kernel; and
a Green + Cyan / Red + Yellow + Blue ColorSelect waveplate
positioned in an input light channel of the kernel.

10

66. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
an input beamsplitter and an output beamsplitter on a first
diagonal of the kernel;
15 a first processing beamsplitter and a second processing
beamsplitter on a second diagonal of the kernel; and
a Green + Cyan dichroic positioned between the input
beamsplitter and the first processing beamsplitter.

20 67. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
an input beamsplitter and an output beamsplitter on a first
diagonal of the kernel;

a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and
a Red + Yellow + Blue dichroic positioned between the input beamsplitter and the second processing beamsplitter.

5

68. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

10 a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel; and

a Red + Yellow / Blue ColorSelect waveplate positioned between the input beamsplitter and the second processing beamsplitter.

15

69. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,

an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;

20 a first processing beamsplitter and a second processing beamsplitter on a second diagonal of the kernel;

a Red + Yellow + Blue dichroic positioned between the input beamsplitter and the second processing beamsplitter; and

a Red + Yellow / Blue ColorSelect waveplate positioned between the input beamsplitter and the second processing beamsplitter.

5 70. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
 an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;
 a first processing beamsplitter and a second processing
10 beamsplitter on a second diagonal of the kernel; and
 a Blue / Red + Yellow ColorSelect waveplate positioned between the second processing beamsplitter and the output beamsplitter.

15 71. The kernel according to Claim 1, wherein the kernel is a quad style kernel comprising,
 an input beamsplitter and an output beamsplitter on a first diagonal of the kernel;
 a first processing beamsplitter and a second processing
20 beamsplitter on a second diagonal of the kernel;
 a Green + Cyan / Red + Yellow + Blue ColorSelect waveplate positioned in an input light channel of the kernel;
 a Red + Yellow + Blue dichroic positioned between the input beamsplitter and the second processing beamsplitter; and

a Red + Yellow / Blue ColorSelect waveplate positioned between the input beamsplitter and the second processing beamsplitter; and

a Blue / Red + Yellow ColorSelect waveplate positioned

5 between the second processing beamsplitter and the output beamsplitter.